WHAT IS CLAIMED IS:

1. A vibrating-tube meter for measuring the density, mass flow rate or viscosity of a fluid material, the meter comprising:

a hollow tube having an inlet end and an outlet end and including a vibration section;

excitation means for inducing vibrations in the tube vibration section at a resonance frequency;

motion sensing means for detecting motion of the tube from the induced vibrations; and

a spring element coupled to the vibration section between a first end and a second end of the vibration section.

2. The vibrating tube meter according to claim 1 wherein the spring element comprises a helical coil spring having opposing ends coupled to the tube.

3. The vibrating tube meter according to claim 1 wherein the at least a portion of the tube is positioned within the interior of the coil spring.

4. The vibrating tube meter according to claim 1 wherein the vibration section of the tube is generally aligned along a tube longitudinal axis and the spring element comprises a helical coil spring having a longitudinal axis oriented generally along the tube longitudinal axis.

5. The vibrating tube meter according to claim 1 wherein the vibration section of the tube is generally straight.

6. The vibrating tube meter according to claim 1 further comprising an external housing rigidly coupled to the tube inlet end and outlet end and having a mass selected to provide a suitable nodal mass for the tube vibration section and spring element.

7. The vibrating tube meter according to claim 1 wherein the spring element is selected to have a spring load constant to isolate the vibration section from vibrations external to the vibration section and spring.

8. The vibrating tube meter according to claim 1 wherein:
the tube vibration section includes a first isolation member attached to the tube near

one end of the vibration section and a second isolation member attached to the tube near another end of the vibration section;
the spring element first end is attached to the first isolation member; and
the spring element second end is attached to the second isolation member.

9. The vibrating tube meter according to claim 8 wherein the first and second isolation members are brazed to the tube, the spring element first end is welded to the first isolation member and the spring second end is welded to the second isolation member.

10. The vibrating tube meter according to claim 1, wherein the tube vibration section has a coefficient of thermal expansion and the spring element is composed of a material selected to have a coefficient of thermal expansion that generally matches the coefficient of thermal expansion of the tube vibration section.

11. The vibrating tube meter according to claim 1, wherein the tube vibration section and the spring element are composed of matching material.

12. The vibrating tube meter according to claim 1, wherein the spring element comprises a steel or titanium.

13. The vibrating tube meter according to claim 1, wherein the tube includes a curved portion.

14. A tube assembly for a densitometer or mass flow meter or viscometer of the vibrating-tube type, the assembly comprising:
a hollow tube having a first isolation member coupled near an inlet end and a second isolation member coupled near an outlet end;
an excitation device coupled to the tube;
one or more motion sensing devices coupled to the tube; and
a spring element coupled to the tube between the first and second internal isolation members.

15. The tube assembly according to claim 14 wherein the spring element comprises a helical coil spring having opposing ends coupled to the isolation members.

16. The tube assembly according to claim 14 wherein the tube includes a section that is generally straight.

17. The tube assembly according to claim 14 wherein the tube includes a section that is generally curved.

18. The tube assembly according to claim 14 wherein the spring element is rigidly attached to the isolation members and the isolation members are rigidly attached to the tube.

19. The tube assembly according to claim 14 wherein each of the isolation members comprises a flange disposed around the tube.

20. The tube assembly according to claim 14 wherein the isolation members are brazed to the tube and the spring element first is welded to the isolation members.

21. The tube assembly according to claim 14, wherein the tube has a coefficient of thermal expansion and the spring element is selected to have a coefficient of thermal expansion that generally matches the coefficient of thermal expansion of the tube.

22. The tube assembly of claim 14 further comprising a temperature sensor coupled to the tube to sense the temperature of the tube.

23. The tube assembly of claim 14 further comprising a temperature sensor coupled to the spring element to sense the temperature of the spring element.

24. The tube assembly of claim 14 further comprising a pressure sensor coupled to the tube to sense the pressure of fluid material in the tube.

25. The vibrating tube meter according to claim 6 further comprising a temperature sensor coupled to the external housing element to sense the temperature of the external housing.

26. A method for manufacturing a vibrating tube densitometer or mass flow meter or viscometer, the method comprising:

providing a hollow tube having an isolation member near an input end and an isolation member near an output end;

coupling one or more excitation devices to the tube;
coupling one or more motion sensing devices to the tube; and
coupling a spring element to the tube between the internal isolation members.

27. The method according to claim 26 wherein the step of coupling the spring element to the tube comprises brazing the isolation members to the tube and welding the spring element to the isolation members.

28. The method according to claim 26 wherein the step of coupling one or more excitation devices to the tube comprises attaching a piezoelectric transducer to the tube.

29. The method according to claim 26 wherein the step of coupling one or more motion sensing devices to the tube comprises attaching a piezoelectric transducer to the tube.